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(54) Title of the invention: A heat-retaining fabric

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Specification

1. Title of the Invention

A heat-retaining fabric

2. Scope of Claims

1. A heat-retaining fabric which is characterized in that on one face of a fabric (1) there is formed a reflective coated film (2) to reflect heat, and on this reflective coated film (2) there is coated a material (3) having low thermal conductivity and possessing heat radiating properties.

2. A heat-retaining fabric according to Claim 1 which is characterized in that on top of the aforesaid reflective coated film (2) there is formed a coating (30) containing a material (3) having low thermal conductivity and possessing heat radiating properties.

3. A heat-retaining fabric according to Claim 1 or Claim 2 which is characterized in that, as the aforesaid material (3) having low thermal conductivity and possessing heat radiating properties, there is used a black body.

3. Detailed Description of the Invention

[Industrial Field of Application]

The present invention relates to a heat-retaining fabric which is used, for example, as a material for producing clothing for protection from the cold.

[Prior-Art and Problems thereof]

In the case of clothing used for protection from the cold, and in particular sports wear such as ski wear, a fabric which is thin but outstanding in its heat retention is desired as the fabric employed as the starting material.

Hence, hitherto, on one face of the fabric employed as the starting material for clothing used for protection from the cold, there has been formed a reflective coated film to reflect heat by forming a reflective resin film by applying resin containing a heat-reflective metal powder such as aluminium, or by vapour-deposition of a metal such as aluminium in a vacuum, or again by affixing aluminium foil. The reflective coated film formed in this way is positioned on the wearer side, so that heat radiated from the body is reflected by this reflective coated film and release of the heat by radiation to the surroundings is prevented.

However, the release of heat from the body to the surroundings is not restricted to that due to radiation, and there is also that produced by thermal conduction and the like, so in the case of a reflective coated film which is metallic and has high thermal conductivity it is not possible to fully suppress the release of heat based on thermal conduction. Hence, it cannot yet be said that the heat-retaining properties are adequate.

Moreover, since this reflective coated film which is metallic and has high thermal conductivity is disposed on the wearer-side as mentioned above, there is also the problem that when the clothes are first put on and this reflective coated film touches the skin, it has a very

cold feeling, and moreover the clothes have an uncomfortable feel when worn. Furthermore, there is the problem that metal contained in the reflective coated film comes away and contaminates the garments worn underneath. In addition, such a reflective coated film has a metallic sheen and reflects light, so there is again the problem that it gives a disagreeable impression.

[Means for Resolving the Problems]

For the purposes of suppressing the release of heat due to thermal conduction which takes place in the case of conventional heat-retaining fabrics as described above, and so further enhancing their heat-retaining properties, and also for the purposes of resolving the various other problems described above, the heat-retaining fabric according to the present invention has the following construction.

In the heat-retaining fabric relating to the present invention, on one face of a fabric (1) there is formed a reflective coated film (2) to reflect heat, and on this reflective coated film (2) there is coated a material (3) having low thermal conductivity and possessing heat radiating properties.

Here, in forming on one face of fabric (1) the reflective coated film (2) to reflect heat, just as in the conventional case there may be applied on one face of fabric (1) a resin containing a metal powder (21) such as aluminium or titanium which reflects heat rays like infrared radiation, to produce a resin film containing said metal powder (21); or there may be vapour-deposited aluminium or other metal in a vacuum;

or again there may be affixed an aluminium foil or the like.

Furthermore, in the coating of material (3) which has low thermal conductivity and possesses heat radiating properties on the reflective coated film (2) formed in this way, there is normally used as said material (3) fine particles of a black body such as carbon particles, graphite particles; aniline black; or fine particles of a synthetic resin such as nylon, polystyrene, polymethyl methacrylate or polyethyl methacrylate which has been coloured black. Moreover, in carrying out the coating, there may be applied a resin containing this material (3) onto the reflective coated film (2) so as to form a coating (30) having low thermal conductivity and possessing heat radiating properties, or said material (3) may be affixed into the form of dots on the reflective coated film (2) by means of a gravure printing machine.

[Action]

In this way, since, in the case of the heat-retaining fabric relating to the present invention, there is further coated a material (3) having low thermal conductivity and possessing heat radiating properties onto the reflective coated film (2) formed on one face of fabric (1), when the fabric is employed with this face on the wearer-side heat transmitted by thermal conduction from the body of the wearer is absorbed by the material (3) which has been coated onto reflective coated film (2) and so release to the surroundings via the reflective coated film (2) is prevented and, moreover, the heat absorbed by material (3) is gradually radiated. Furthermore, with regard to the radiation of

heat from material (3) in this way, while there will also be radiation from said material (3) in the direction opposite that of the wearer, such radiated heat will be reflected by the reflective coated film (2) positioned underneath, so all the heat is actually radiated towards the wearer side.

Again, since material (3), which has low thermal conductivity and possesses heat radiation properties, is coated onto reflective coated film (2), the metallic reflective coated film (2) in the heat-retaining fabric is no longer exposed and there is little contact of this with the body.

[Examples]

Next, practical examples of the invention are explained based on the drawings.

In the example shown in Figure 1, a reflective coated film (2), to reflect heat, is formed on one face of fabric (1) by application of a resin containing flat metal powder which reflects heat, such as aluminium or titanium. Furthermore, on this reflective coated film (2) there is formed a coating (30) which has low thermal conductivity and possesses heat radiating properties, by application of a resin containing the material (3) black body particles of low thermal conductivity and possessing heat radiating properties. Here, as the resin employed in the formation of the reflective coated film (2) and the coating (30), there is preferred a resin possessing flexibility at low temperatures and which is excellent in its washing and abrasion resistance. Normally, there will be used a resin such as a polyurethane or polyacrylate resin. Again, in

forming the coating (30) which has low thermal conductivity and possesses heat radiating properties, it is usually preferred that the resin contains at least 10 wt% of the black body particles which constitute material (3), so that the release of heat by conduction is suppressed and heat radiation is fully carried out.

In the example shown in Figure 2, reflective coated film (2) is formed in the same way as in the above example on one face of fabric (1) and, on top thereof, the black body particles which constitute material (3), and which have low thermal conductivity and possess heat radiating properties, are affixed in the form of dots by means of a gravure printer. Here, in affixing the material (3) black body particles which have low thermal conductivity and possess heat radiating properties on top of reflective coated film (2) in the form of dots, in order to fully absorb the heat due to thermal conduction from the body and to fully carry out radiation thereof, it is normally preferred that the dots comprise at least 35% of the area of the reflective coated film (2).

Next, in order to demonstrate the excellent heat retention of the heat-retaining fabric relating to the present invention, a specific example is explained.

In this example, as the fabric, there was used a woven material comprising a 210 yarn nylon taffeta employing 70d-68 filament nylon yarn, which was subjected to dyeing and finish setting, after which it was immersed in a fluorine-based waterproofing liquid, then mangled to give a 60% take-up of the waterproofing liquid by fabric weight, followed by drying to effect application of the waterproofing agent and then finish setting for

40 seconds at 160°C. Here, the application of the waterproofing agent to the fabric was carried out to prevent the penetration of the fabric by the resin liquid in the subsequent formation of the reflective coated film.

Next, onto one face of this fabric there was formed a reflective coated film to reflect heat, by the application at a coverage of 30 g/m^2 of a resin liquid comprising 100 parts of Reocoat 9054 [a Daiichi Lace Mfg Co. product] in which urethane resin is the main component, 5 parts of the melamine crosslinking agent Super Bekkamin J-820 [a Dainippon Ink & Chemicals Inc. product], 1 part of a 20% isopropyl alcohol solution of p-toluenesulphonic acid, 10 parts of heat-reflective flat aluminium powder Al-18000 [a Fukuda Kinzoku (K.K.) product] and 45 parts of toluene.

Then, on top of the reflective coated film formed in this way, there was formed a coating with low thermal conductivity and possessing heat radiating properties by application at a coverage of 30 g/m^2 of a coating liquid comprising 100 parts of the aforesaid Reocoat 9054 [a Daiichi Lace Mfg Co. product], 5 parts of the melamine crosslinking agent Super Bekkamin J-820 [a Dainippon Ink & Chemicals Inc. product], 1 part of a 20% isopropyl alcohol solution of p-toluenesulphonic acid, 20 parts of the black pigment Dilac WT-colour/#black [a Dainippon Ink & Chemicals Inc. product] containing carbon particles as the material of low thermal conductivity and possessing heat radiation properties, and 30 parts of a (1 : 1) toluene/methyl ethyl ketone mixed solvent, and then drying.

When compared to the case where only a reflective coated film was formed, the heat-retaining fabric of the present invention where a coating having low thermal conductivity and heat radiation properties was formed on top of the reflective coated film was about 0.5 clo better in its heat-retention.

[Effects of the Present Invention]

As explained in detail above, in the case of the heat-retaining fabric relating to the present invention, the reflective coated film formed on one face of the fabric is further coated with a material having low thermal conductivity and possessing heat radiation properties, so heat transmitted from the body of the wearer by thermal conduction is absorbed by this material and the heat thus absorbed is gradually radiated. Thus, as well as there being no release to the surroundings of such heat through the reflective coated film of high thermal conductivity, the heat which is radiated from this material in the opposite direction to the wearer is itself reflected by the reflective coated film underneath, so that all of the radiated heat is directed towards the wearer side, and the heat retention is further enhanced.

Furthermore, since, in this heat-retaining fabric, the metallic reflective coated film is coated with a material having low thermal conductivity and possessing heat radiation properties, there is no aforedescribed very cold feeling when the clothes are first put on and the metallic reflective coated film touches the skin, and so the sense of warmth on contact is excellent.

Moreover, since the metallic reflective coated film has been coated with this material, as well as it feeling very comfortable, there is no separating-away of metal contained in the reflective coated film and no contamination of the garments underneath. Again, there is no disagreeable impression caused by exposure of the metallic reflective coating.

4. Brief Explanation of the Drawings

The drawings illustrate practical examples of the present invention, Figure 1 being a sectional view of an example in which there is formed on the reflective coated film a coating containing a material of low thermal conductivity and having heat radiation properties, and Figure 2 being a sectional view of an example where the material of low thermal conductivity and having heat radiation properties is affixed in the form of dots on the reflective coated film.

Explanation of the Numerical Codes

(1) ... fabric (2) reflective coated film
(3) ... material of low thermal conductivity and possessing heat radiation properties
(30) ... coating

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Figure 1

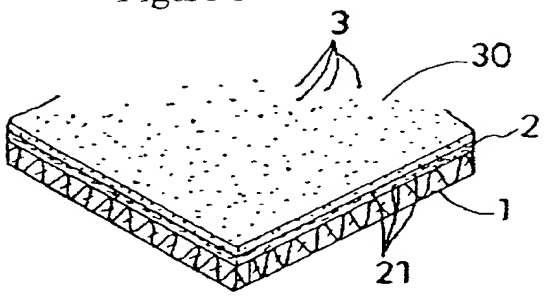

Figure 2